Electronic Supplement to

Low-Frequency Ambient Noise Autocorrelations: Waveforms and Normal Modes

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This electronic supplement contains amplitude spectra for the gravest modes of the 11 March 2011 Tohoku-Oki earthquake as recorded on GEOSCOPE station TAM (Tamanrasset, Algeria) in Algeria.

Gravest Modes of the 2011 Tohoku-Oki Earthquake

The main goal of the article is to examine the performance of the different autocorrelations, based on the conventional cross correlation (CC; equation 1 in the main article), geometrically normalized cross correlation (CCGN; equation 2 in the main article), and phase cross correlation (PCC; equation 3 in the main article) on ambient noise data. We focus to low-frequency vertical-component data and the extraction of the Earth orbiting Rayleigh waves and spheroidal modes. To this end, we use 11 March 2011 Tohoku-Oki earthquake data as recorded on GEOSCOPE station TAM and show that the three methods perform differently, please see the main article for further details. Figure S1 shows the gravest Earth modes ($f < 1$ mHz) of the same event for completeness. The data processing did not change, but the seismogram was 10 days long and therefore includes a large number of aftershocks that maintained the Earth oscillating. From Figure S1, some splitting of multiplets is visible, and it seems that CCGN and PCC can resolve more singlets (e.g., see 0S3) than CC. We did not further analyze the singlets, which is out of the scope of this article.

Figure

Figure S1. Amplitude spectra for the gravest modes of the 11 March 2011 Tohoku-Oki earthquake as recorded on GEOSCOPE station TAM in Algeria. Seismic recordings had a length of 10 days and spectra were obtained through the Fourier transform of the autocorrelations computed by following equations (1) (CC), (2) (CCGN), and (3) (PCC). The equation numbers refer to the main article. Plotted are the normalized amplitudes after taking the square root of the spectra amplitudes. The solid and dotted lines mark the fundamental and higher spheroidal modes following preliminary reference Earth model (PREM).

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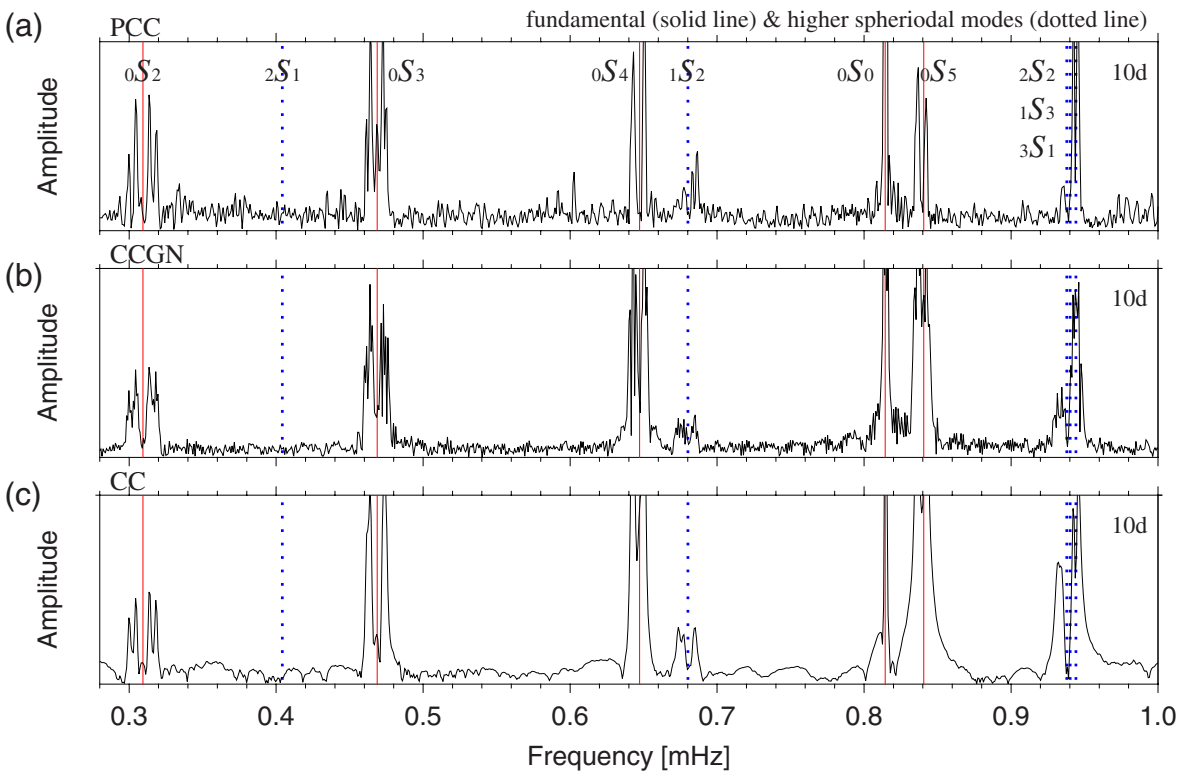
(a)
PCC
fundamental (solid line) & higher spheriodal modes (dotted line)
$_0S_2$
$_2S_1$
$_0S_3$
$_0S_4$
$_1S_2$
$_0S_0$
$_0S_5$
$_2S_2$
$_1S_3$
$_3S_1$
10d
Amplitude
(b)
CCGN
10d
Amplitude
(c)
CC
10d
Amplitude
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Frequency [mHz]